engenuiti

23 WEST HEATH ROAD (SARUM CHASE)
HAMPSTEAD

STRUCTURAL ENGINEERING METHOD STATEMENT

for

LAURENCE KIRSCHEL

DECEMBER 2017

760-S-SMS-001
Rev 01

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STRUCTURAL ENGINEERING – STRUCTURAL METHOD STATEMENT

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Revision History

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1 EXECUTIVE SUMMARY

1.1.1 Engenuiti has been appointed to provide structural and civil engineering design services for the construction of a basement to the rear and under the existing garage of 23 West Heath Road, Hampstead, London for Mr L Kirschel.

1.1.2 This report describes the structural solution, the interaction of basement with the local geology and its impact on surrounding buildings. Construction techniques are highlighted along with particular requirements for temporary works and excavations.

1.1.3 The site is located in the London borough of Camden, on the junction of West Heath Drive and Platt's Lane. The property is on the south side of West Heath Drive. The existing property is a four storey grade II listed neo-Tudor detached house with part basements under the existing rear terraces, built in 1932/33 by for artist Frank Salisbury.

1.1.4 A site investigation has been carried out by Geotechnical & Environmental Associates (GEA). From the Borehole investigations carried out on site the ground conditions generally consist of made ground or finishes overlying the Bagshot Formation, which in turn is located over the Claygate member, which was identified at 6m below the garden ground level. The underlying geology is London Clay. Groundwater was encountered as a slow seepage at 13.0 m (98.72 m OD) during drilling in Borehole No 1 to the front of the property, and standpipes set at between 5 and 6m below ground level have been found to remain dry.

1.1.5 A ground movement assessment report has been prepared by GEA. This report concludes that the predicted damage to Sarum Chase and neighbouring properties would be categorised as "negligible to very slight", in accordance with the Burland Scale, once a suitable propping scheme to the rear basement excavation is accounted for. Once contractors have been appointed it is proposed to undertake additional analysis to verify the proposed propping scheme to ensure that displacements of the piled basement walls achieve the limits as proposed by GEA.

1.1.6 The proposed basement structure is to be formed using reinforced concrete construction. Under the garage this facilitates construction using an underpinning and segmental wall construction method, in the rear garden this facilitates the use of concrete piles with concrete lining walls. A concrete solution also provides a robust structure to resist lateral and vertical earth pressures and can provide a waterproof, dry internal environment.

1.1.7 The proposed redevelopment comprises the following structural works:

- Installation of permanent piled walls to the rear of the property.
- Temporary propping to the inside of the garage to resolve lateral earth pressures during the subsequent excavation works.
- Permanent supports installed under the existing plant room slab to support the Ground Source Heat Pump over.
- Underpinning to the existing garage, including plant room, to form an additional storey beneath.
- Cutting out and underpinning beneath the internal utility room of the property to form an access stairwell.
- Reinstatement of the garage floor slab
- Excavation between propped piled walls to form the basement under the rear garden terrace.
- New slab constructed over the rear garden terrace basement capable of supporting soil and hydrostatic loads over.
- Breaking through between the three excavated spaces to form services routes as required.
- Removal of temporary propping
- Cutting down top of piles in garden where required.
- Site reinstatement

1.1.8 Noise and vibration management will be tailored to reduce nuisance from these two sources to a practical minimum within legal limits following consultation with adjoining property owners prior to the commencement of piling works and basement excavation.

1.1.9 The best practice for the control of Dust and Emissions is to be undertaken in accordance with *The Mayor of London's Best Practice Guide.*

2 INTRODUCTION

2.1 General

2.1.1 Engenuiti has been appointed to provide structural engineering design services for the construction of a basement to the rear and under the existing garage of 23 West Heath Road, Hampstead, London, for Mr L Kirschel.

2.1.2 The purpose of this Report is to describe the structural scheme and proposed sequence of works for the construction of new areas of basement.

2.1.3 This report has been produced for the exclusive use of Mr L Kirschel and should not be used in whole or in part by any third parties without the express permission of Mr L Kirschel or Engenuiti in writing.

2.1.4 This report should not be relied upon exclusively by Mr L Kirschel or any other party for decision making purposes and should be read in conjunction with other documents and drawings produced by the design team.

2.2 Report Structure

2.2.1 Section 3 details the site conditions which are discussed with reference to a general desk study of the geology and site investigation results.

2.2.2 Section 4 covers the proposed design solution for the basement.

2.2.3 Section 5 covers noise, dust and vibration assessment.

2.2.4 Section 6 discusses the construction sequence and temporary works.

2.3 Associated Documents

2.3.1 In addition to this report please take note of:

2.3.2 Appendix A: Construction Sequence Methodology

2.3.3 Appendix B: Geotechnical Investigation Report, Geotechnical Design Basis Report, Ground Movement Analysis

2.3.4 By others: Heritage Report (CGMS), Arboricultural Impact Assessment Report (Landmark Trees), Construction Management Plan (Russell Thompson)

3 SITE & GROUND CONDITIONS

3.1 Background

3.1.1 A desk study of the geology was undertaken for the site based on understanding of similar nearby sites as well the understanding of the site developed during a previous ground investigation on site by GEA, and assessment of existing data sourced from the British Geographical Survey (BGS). The desk study has been followed by a detailed site investigation. The site investigation was carried out by Geotechnical & Environmental Associates (GEA).

3.2 Site Location

3.2.1 The site is located in the London Borough of Camden, to the south of Hampstead Heath, where West Heath Road joins Platt's Lane.

3.2.2 The existing property consists of a Grade II listed four storey detached property, built in the neo-Tudor style.

3.2.3 The site is located on a slope that the house is set in to, such that the ground floor at the front of the property is effectively a basement at the rear of the property.

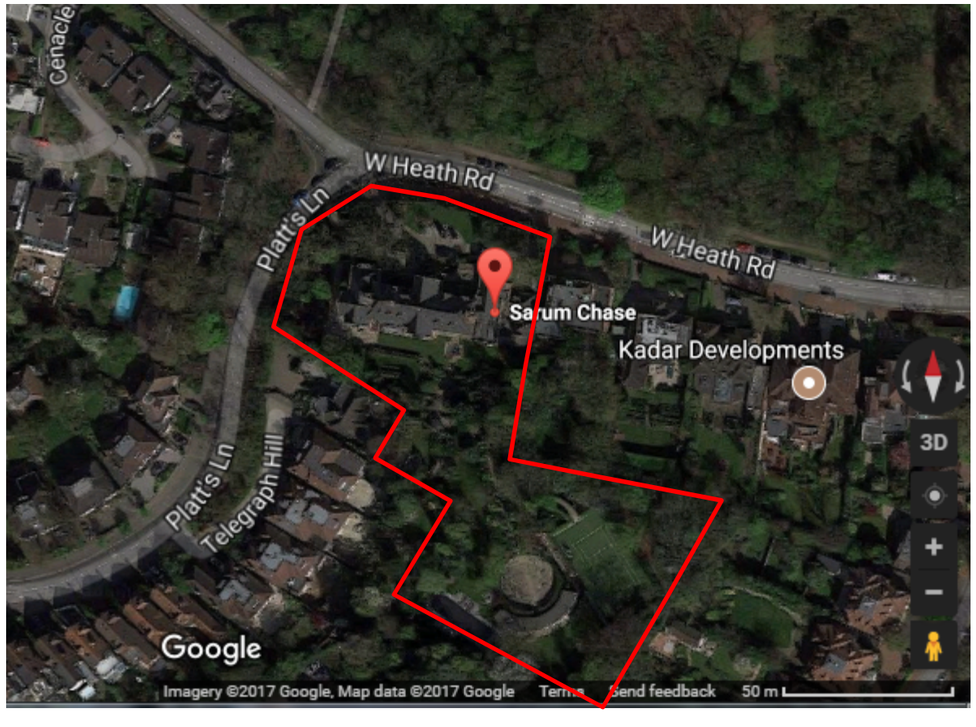

Figure 3.1: Site location plan, boundary shown approximately (extract from Google Maps)

Figure 3.2: Front of property taken from west driveway

3.3 Ground Investigation

3.3.1 A site specific ground investigation has been carried out by GEA and their report reference J16233 complete dated January 2017 can be found in Appendix B. This report includes an assessment of the hydrological impacts of the proposed basement. The accompanying Ground Movement Assessment, covering ground movements resulting from the basement construction is presented in Appendix C.

3.3.2 The ground is generally sloping across the site, with a ground level of approximately 115.2m AOD at the rear of the property, and 111.1m AOD at the front. From the Borehole investigations carried out on site the ground conditions at the rear of the property is:

- 300mm of top soil underlain by made ground extending to a depth of 2.5m. The Bagshot Formation was encountered at 2,5m below ground level, and the Claygate member at 6m BGL.

And at the front of the property:

- The driveway is constructed directly on top of the Bagshot Formation, with the Claygate Member identified at 1.65m BGL.
- The Bagshot Formation comprised of very silty very sandy clay at the front of the property and a dense medium to fine grained sand at the rear of the property.

3.3.3 The underlying Claygate Member was found to be extremely variable; at the front of the property it

comprised alternating horizons of medium dense clayey silty sand, sandy silt and a silty clay, to the maximum depth investigated of 18.00 m (93.72 m OD). To the rear of the property it was more uniform and comprised medium dense very silty slightly clayey fine grained sand with partings of greyish orange-brown clay to 15.0 m depth (100.23 m OD).

3.3.4 Groundwater was encountered as a slow seepage at 13.0 m (98.72 m OD) during drilling in Borehole No 1 to the front of the property. Standpipes varying from 5 to 6m deep have been installed, to date they have been found to remain dry.

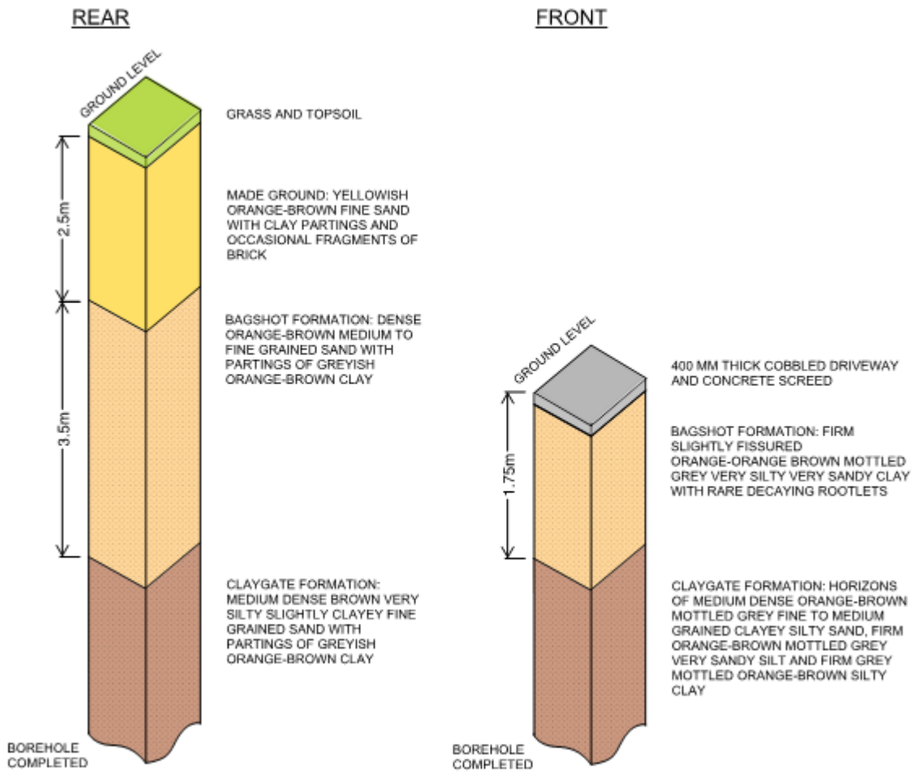

Figure 3.3: Ground Profile Diagram for the front and rear of the property

Ground Movements

3.3.5 A ground movement assessment report has been prepared by GEA. This report details the analysis that was undertaken and assessment based on current best practice.

3.3.6 A ground movement assessment report has been prepared by GEA. This report concludes that the predicted damage to neighbouring properties would be categorised as "negligible to very slight", in accordance with the Burland Scale. Without supplementary propping, one wall forming part of the Sarum Chase property has been assessed as at risk of damage that would be categorised as damage category 2, "slight". However, with a suitable propping scheme designed to limit vertical and horizontal displacements of the piled walls to the rear basement GEA conclude that the wall would be subjected to damage category 1, "Very Slight". Once contractors have been appointed it is proposed to undertake additional analysis to verify the proposed propping scheme to ensure that displacements of the piled basement walls are limited and the damage category limited to "Very Slight". Further, a monitoring programme is proposed to monitor wall displacements throughout the excavation period, such that appropriate action, such as upgrading the propping system, can be taken should actual displacements be found to be larger than predicted.

Refer to Appendix B for full geotechnical analysis and report (reference J16233).

Hydrological Assessment

3.3.7 The GEA report (appendix B) includes a hydrological assessment which states that:

3.3.8 "The site is underlain by the Bagshot Formation sands which are designated a Secondary Aquifer by the Environment Agency, capable of supporting flow to watercourses and private abstractions. Aquifer designation maps acquired from the Environment Agency as part of the desk study and Figures 3, 4 and 8 of the Arup report confirm this."

The assessment goes on to state that

"The proposed basement will extend to a depth of 5.0 m below ground level at the rear of the property and 3.0 m to 4.0 m below ground level beneath the eastern part of the property. The previous investigation performed by GEA on site indicated groundwater to be absent to a depth of 5 m below ground level at the front and rear of the property."

3.4 Highway

3.4.1 The proposed basement construction is not adjacent to any public highway, and as such is not subject to local authority approval.

3.5 Railway/Underground Tunnels

3.5.1 There are no known underground or ail tunnels within 250m of the site, and as such no approvals have been sought.

3.6 Water Infrastructure

3.6.1 No known public sewer or lateral drain is known to be within the immediate vicinity of the works, although there are multiple services for the property which will require safeguarding including water, sewerage and gas.

4 PROPOSED STRUCTURE

4.1 General

4.1.1 The proposed redevelopment works comprise of two key areas, the basement below the garage, and the rear garden games room. The structural approach is as follows.

4.2 Games Room Structural Form and Stability

4.2.1 CFA piled secant retaining walls are constructed around three sides of the games room, with the existing property forming the fourth side. CFA piling selected so as to minimise ground disturbance and noise. A capping beam is located to span between the piles. A thick basement slab combined with a heave protection layer spans between the piled walls and four unique piles closer to the property, resisting both vertical gravity loads and also heave and hydrostatic loads in bending and shear. These loads are subsequently resisted as compression and tension loads to the CFA piles.

4.2.2 A 450mm thick slab spans between the capping beams and walls, providing the top to the games room. This slab transfers loads from the backfilled soil as well as any surcharge loads in bending and shear to the piled walls.

4.2.3 Lateral loads are applied as a result of out of balance soil loads on the structure. To the south the piled wall will retain soil, to the north the new wall is immediately adjacent to the existing property, and level with existing inside spaces. As the property is set in to the slope, no soil load reaction is applied to the new structure from the existing property. The piled retaining wall to the south of the games room therefore resists the lateral ground pressures in bending and shear, spanning between the excavation base and capping beam. The two stiff concrete diaphragms (base and lid) resist the lateral load applied by the piles, transferring it in in-plane bending and shear to the shorter piled return walls. These return walls resist the lateral load in base shear, and any over-turning action is resisted as a push-pull action along the length of the piled wall.

4.2.4 In the east-west direction soil loads are generally balanced, with loads transmitted across the structure by the piles in bending and shear, and the floorplates in compression. Any slight out of balance forces will result in a push pull action in the shorter return walls, as outlined above.

4.2.5 Although not set in to the groundwater, the games room is designed to resist temporary hydrostatic loads for example due an extreme weather event. Water is prevented from entering the basement through the use of a water resisting concrete additive in both the lining walls and slabs. An additional drained cavity systems set inside the concrete walls helps to further assure a habitable basement construction. All retaining walls are designed to support a hydrostatic load of 75% of their height.

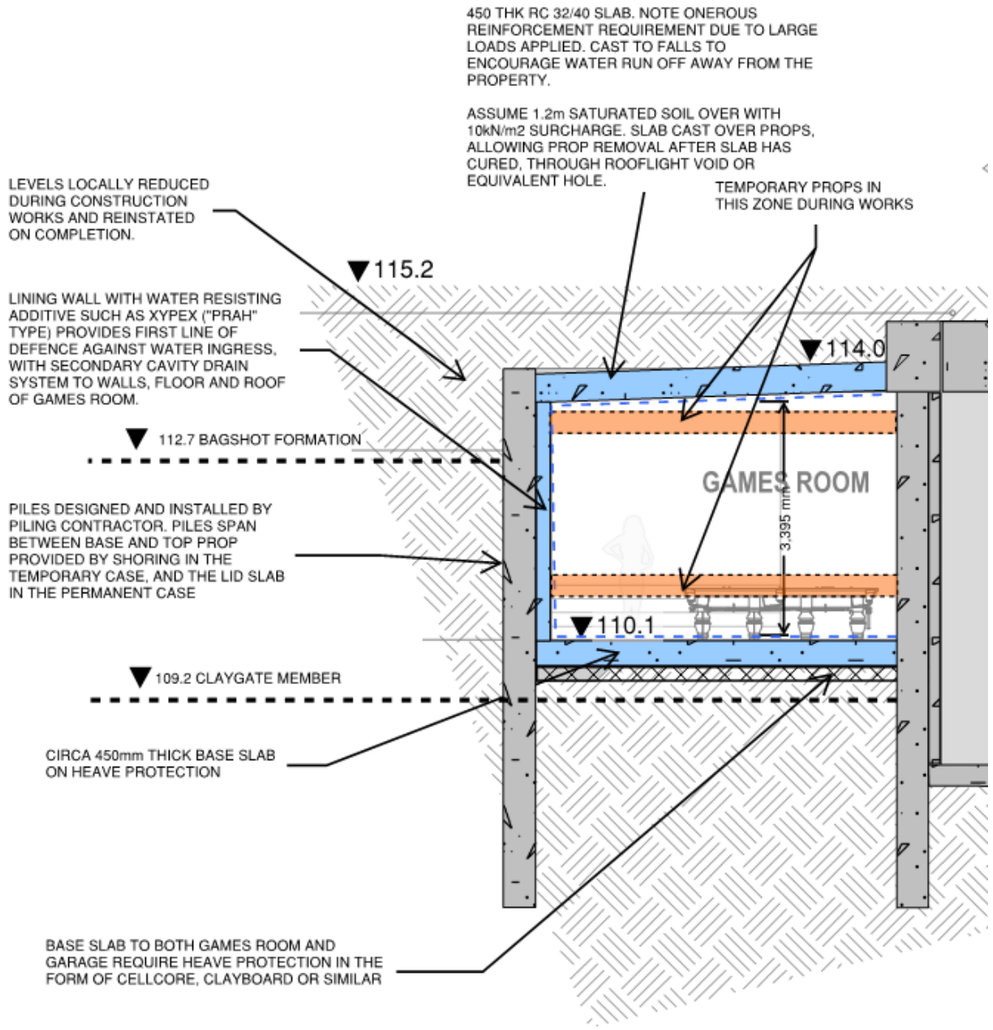

Figure 4.1: Section through new games room basement in garden

4.2.6 Construction sequence diagrams are provided in Appendix A, and the sequence outlined below.

- Site set-up and establish site hoarding.
- Cutting off of existing services where not required or obstructive and provision of temporary services.
- Establish skip system for waste removal, including possible conveyors in side alley.

- Carefully demolish existing terrace wall by hand and retain masonry for re-use.
- Undertake piling (anticipated to be a 450mm CFA rig). Pumping lines for concrete delivery to be laid in side alley.
- (Undertake work to garage basement)
- Introduce top level prop
- Excavate, introducing additional propping as required.
- As excavation progresses also underpin the library bay window in short sections.
- Install heave protection and cast base slab
- Install separating membrane and polystyrene to interface of new and existing basement areas.
- Cast water resisting lining walls, incorporating box frame around door opening.
- Cast lid slab using water resisting concrete.
- Remove props
- Remove temporary equipment such as lifting frames, conveyor, and concrete lines.
- Fit cavity drain, water resisting membranes.
- Reinstate services
- Backfill
- Reinstate planting and fit out.

4.3 Basement Under Garage Structural Form and Stability

4.3.1 The basement under the garage is to provide additional back of house space, such as a staff break/kitchen area and utility room.

4.3.2 The existing garage is a two storey structure built at the same time as the original house, with a garage for vehicles at ground floor and accommodation for staff in flats over. During the period 2005-2015 the garage which originally stepped to follow the line of the sloping site, was extended at ground level back into the slope to provide additional plant space. Access to the flats over was also reconfigured to provide additional accommodation space over.

4.3.3 The general structure is formed by careful underpinning of the garage. Underpinning is to be undertaken in short sections of approximately 1.5m in length so as to minimise movements in the structure over or in adjacent structures. An existing plant room is located on the existing garage floor plate. This is to remain in situ. The existing slab here will be retained, and the slab supported using a grillage of reinforced concrete beams that are to be carefully poured under the plant room slab, and supported on two cast-in-situ concrete lintel beams.

4.3.4 Gravity loads are transferred through the masonry over and the underpins to the underlying Claygate member. The underpins are constructed as retaining walls with a root thickening to help distribute the loads back into the soil. Both the new garage slab and the basement slab span simply supported between the underpins. During the detailed design phase, the underpins bases will be sized so as to achieve approximately equal pressures to the underside of the foundation in all locations, minimising the risk of differential settlement.

4.3.5 Hydrostatic loads and loads resulting from heaving of the soil are similarly resisted in bending and shear in the basement slab. Overall stability has been checked to ensure that the overall weight of the garage and basement structure is sufficient to resist the hydrostatic pressure and heave. As with the games room, although the basement is not located in groundwater it is designed to resist hydrostatic pressure that could result from an extreme weather event or similar. The central portion of the basement slab similarly has heave protection to further reduce the impact of heave loads on the structure.

4.3.6 Lateral loads in the east-west are resisted by friction between the basement footings and the ground, the thickenings at the root of the retaining walls helps to provide a key to resist such actions. In the north-south direction the piled retaining wall to the rear light-well spans vertically between the base slab and the capping beam, transferring soil and hydrostatic loads in bending and shear. The capping beam in turn spans between the return walls, resisting loads in base shear and tension/compression to resist any overturning along the length of the wall.

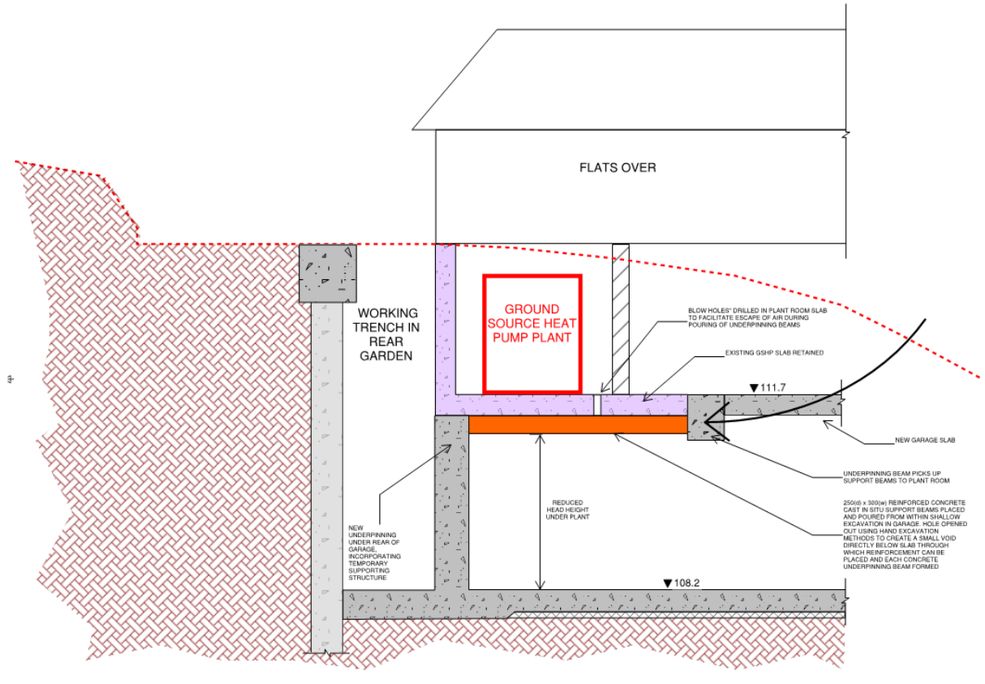

Figure 4.1: Section through retained plant room slab

4.3.7 Construction sequence diagrams are provided in Appendix A, and the sequence outlined below.

- Site set-up and establish site hoarding.
- Asbestos survey and removal (if required).
- Cutting off of existing services where not required or obstructive and provision of temporary services.
- Strip out of existing partition walls, removal of wall tiles
- Introduce propping at level of existing corbels
- Partially excavate rear light-well.
- Underpin strips immediately adjacent to retained plant room slab.
- Install beams under retained plant room slab
- General underpinning: Underpin opposing walls in short sections, introducing additional propping as required
- Specialist excavation to facilitate underpinning under Ground Source Heat Pump plant room
- Install heave protection and cast base slab over to match underpins
- Cast new garage slab, remove propping once cured
- Install water-resisting lining wall
- Install cavity drain
- Fit out and reinstate services

5 STRUCTURAL MONITORING

5.1 Condition Survey

5.1.1 Prior to commencing construction work, the following surveys are proposed:

5.1.2 Undertake condition survey inside and out of garage, flats over, plant room, library, playroom, hall.

5.1.3 Undertake condition survey inside and out of neighbouring property.

5.1.4 Condition survey provides baseline against which to judge any future concerns re property movement/damages.

5.1.5 Any existing cracks are to have tell-tails fitted for future monitoring.

5.2 Structural Monitoring

5.2.1 Prior to commencing construction work, survey points should be established on the existing buildings as follows:

5.2.2 Establish survey points on Sarum Chase (15 points) and No. 21 West Heath Road (10 points anticipated).

5.2.3 Baseline survey data of a minimum two months (weekly data) to be established, prior to excavation works commencing.

5.2.4 The following monitoring steps are proposed:

i Green: No action required.

ii Amber: increase frequency of monitoring, review site activities, prepare upgraded propping design if appropriate

iii Red: Suspend excavation, continue monitoring, upgrade propping and/or change construction sequence.

5.2.5 Survey points are to be surveyed weekly during underpinning and piling operations.

5.2.6 Weekly condition survey to check for any visible cracks/damage during underpinning and piling works.

5.2.7 Any new cracks to be fitted with tell-tails and subjected to ongoing monitoring.

5.2.8 Structural monitoring frequency to be reviewed following completion of groundworks, if movements during works slight then continue monitoring on a fortnightly basis during contract completion. If movement judged to be causing concern then weekly monitoring to continue.

APPENDIX A: CONSTRUCTION SEQUENCE METHODOLOGY

Consisting of:

760-SK-002: SITE PLAN

760-SK-008: CONSTRUCTION SEQUENCE METHODOLOGY (FLOOR PLANS)

760-SK-009: PROPOSED DRAINAGE

760-SK-011: PROPOSED SECTIONS

760-SK-012: GROUND SOURCE HEAT PUMP SUPPORT SEQUENCE

760-SK-013: PROPOSED UNDERPIN SEQUENCE

760-SK-014: REAR BASEMENT SEQUENCE

760-SK-015: SITE CONSTRAINTS MAP

760-SK-016: DIVERSION OF SERVICES

760-SK-017: OPENING UP WORKS PROPOSED

APPENDIX B: GEOTECHNICAL INVESTIGATION REPORT, GEOTECHNICAL DESIGN BASIS REPORT, GROUND MOVEMENT ASSESSMENT